E Prime Layer

Source: HT

Why in News?

According to a research conducted at the Advanced Photon Source of Argonne National Lab and PETRA III of Deutsches Elektronen-Synchrotron in Germany, a new mysterious layer called the **E prime layer** has formed on the outer part of the **Earth's core.**

- This happened because **surface water penetrated deep into the planet,** changing the composition of the outer region of the **liquid metal core.**

How Did E Prime Layer Develop Over Time?

- **Tectonic Plates Transporting Water to Earth's Core:**
  - New research reveals a fascinating process where **tectonic plates,** carrying surface water, have been transporting it deep into the Earth's interior over billions of years.
  - As this water reaches the core-mantle boundary, located approximately 1,800 miles beneath the Earth's surface, **it instigates significant chemical changes that directly influence the structure of the Earth's core.**
- **Chemical Reactions and Structural Impact on Earth's Core:**
  - Observations by scientists highlight the chemical reactions occurring **when subducted water interacts with core materials** under high pressure.
  - This interaction results in the creation of a distinct layer in the outer core **characterized by high hydrogen content and low silicon levels**, forming a film-like structure.
  - Additionally, **the process generates silica crystals that ascend into the mantle,** causing compositional changes.
    - These alterations in the liquid metallic layer have potential implications, including reduced density and modified seismic characteristics.
- **Significance of E Prime Layer in Understanding Earth More:**
  - This finding suggests a more **intricate global water cycle than previously recognized.** The altered core layer carries significant implications, **shedding light on the interconnected geochemical processes** that link surface water cycles with the deep metallic core.

INTERIOR OF THE EARTH

1 THE CRUST

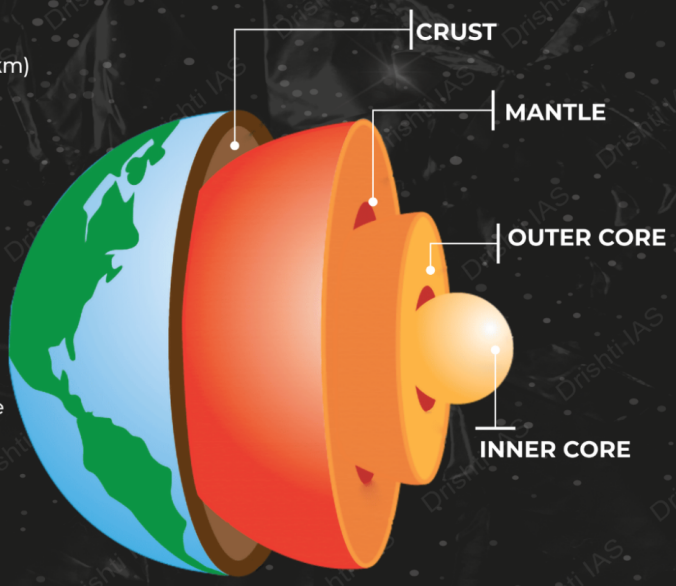
- Thin, outermost layer
- Oceanic crust – thinner
  - Mean thickness -5 km
  - Made up of Silica and Magnesium (SiMa)
- Continental crust – thicker
  - Mean thickness - 30 km
  - Made up of Silica and Aluminum (SiAl)
  - Thicker in the areas of major mountain systems.
    - Around 70 km thick in the Himalayan region.
- Temperature increases with depth (rises by up to 30° C for every km)

Lithosphere

- Rigid outer layer, thickness: 100 km
- Consists of the crust and the upper mantle
- Divided into tectonic plates responsible for large-scale changes in the earth's geological structure (folding, faulting)

2 THE MANTLE

- Extends from Moho's discontinuity to a depth of 2,900 km
- Upper portion is called asthenosphere
  - Zone of weak rocks; in semi molten or jelly like state
  - Extends upto 400 kms
  - Main source of magma that comes out of volcanic eruptions



3 THE CORE

- Lies between 2900-6370 km below the earth's surface
- Made up of heavy materials, primarily nickel (Ni) and iron (Fe) - NiFe
- Outer core –
  - Between 2900-5100 kms
  - Liquid because of not enough pressure to solidify
- Inner core –
  - Between 5100-6370 kms
  - Solid – it can transmit secondary waves (earthquake) which outer core can't
- Denser than Mantle

Boundaries/discontinuities between Earth's layers

1. Conorod Discontinuity– between upper and lower crust
2. Mohorovicic Discontinuity (Moho) – separates the crust rom the mantle, its average depth being about 35 km.
3. Repiti Discontinuity – between the upper and lower mantle
4. Gutenberg Discontinuity – lies between the mantle and the outer core.
5. Lehman Discontinuity- between inner and outer core

Drishti IAS

UPSC Civil Services Examination, Previous Year Question (PYQ)

Prelims

Q 1. In the structure of planet Earth, below the mantle, the core is mainly made up of which one of the following? **(2009)**

(a) Aluminium
(b) Chromium

(c) Iron
(d) Silicon

Ans: (c)

Mains

Q. Define mantle plume and explain its role in plate tectonics. **(2018)**